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Multidrug-resistant tuberculosis household contact screening and management by community healthcare workers in Mongolia: a prospective implementation study

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Summary

Background Mongolia is a high burden country for multidrug- or rifampicin-resistant tuberculosis (MDR/RR-TB). The implementation of systematic household TB contact investigation has been very limited despite policy recommendations. We implemented a community-based approach to MDR/RR-TB contact screening and management.

Methods We conducted a prospective implementation study in the nine districts of Ulaanbaatar and 10 other provinces. Community health workers (CHWs) were trained to identify and screen household contacts of patients with confirmed pulmonary MDR/RR-TB. Initial screening included symptom assessment for all with chest radiography for adult contacts or tuberculin skin test (TST) for child or young adolescent contacts (<15 years). Follow-up visits to households were conducted quarterly for 12 months. Six months of daily levofloxacin (6Lfx) was offered to eligible contacts, i.e. <15 years, TST-positive and without disease.

Findings Of 99 people with pulmonary MDR/RR-TB, 349 household contacts were identified and 347 (99.4%) were screened by CHWs at initial home-based visit. Contact screening coverage remained high (>98%) for each quarterly visit up to 12 months of follow-up. TB was diagnosed in 17 contacts (4.9%); ten from initial screen, seven from follow-up screen and 12 (71%) were children or adolescents. Four contacts were diagnosed with bacteriologically confirmed MDR/RR-TB and two died. 6Lfx was initiated in 15 (43%) of 35 eligible contacts who all completed therapy without interruption.

Interpretation A decentralized model for the screening and management of MDR/RR-TB contacts implemented by trained CHWs has wider potential for increasing TB detection and prevention in Mongolia and the region.

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Keywords: Drug-resistant tuberculosis; Household contact; TB preventive treatment; Decentralisation; Community healthcare workers, Mongolia

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Research in context

Evidence before this study

Mongolia has a high burden prevalence of tuberculosis (TB) and multidrug/rifampicin-resistant (MDR/RR) TB. Previous research has evaluated novel treatment regimens to treat people with MDR/RR-TB but not their household contacts despite being a recognised high-risk group. Consensus management guidelines for household MDR/RR-TB contacts were developed that included: an initial screen for TB of all contacts within 14 days of the index case diagnosis; consider TB preventive treatment (TPT) for child contacts (<15 years) with evidence of TB infection and without TB disease; and follow-up screenings for TB of all contacts. However, implementation of care for contacts of people with TB, both drug-susceptible and MDR/RR-TB, has been very limited in Mongolia and has relied on a passive, facility-based approach to management.

Added value of this study

A novel, decentralised community-based approach to the screening and management of household contacts of people with MDR/RR-TB in Mongolia has shown that a very high screening coverage can be achieved and maintained over one year by trained community healthcare workers supported by TB clinicians at TB dispensaries. The nationwide study provided original evidence from Mongolia of active case detection within household MDR/RR-TB contacts as well as of the introduction of a novel TPT regimen of six months of levofloxacin for child contacts with evidence of infection and without TB disease.

Implications of all the available evidence

This model of care has potential for Mongolia and the region to increase and support implementation of care for household TB contacts, including drug-susceptible TB contacts, and to support the introduction of novel TPT regimens for contacts of all ages.

Introduction

Mongolia is listed by the World Health Organization (WHO) as a high-burden country for tuberculosis (TB) and for multidrug- or rifampicin-resistant tuberculosis (MDR/RR-TB).[1] In 2016, a National TB Prevalence Survey found that the prevalence of TB was 757 per 100,000 population–approximately three times higher than previously estimated. The National TB Drug Resistance Surveillance Survey reported that MDR/RR-TB prevalence was 5.3% among new TB notifications in 2016–2017.[2,3] In 2023, estimated incidence of all TB and MDR/RR TB was 491 and 34 per 100,000 population, respectively, with the highest number of people with TB being males aged 35–54 years.[1]

TB transmission within households poses a significant public health challenge. There is a risk of infection among contacts of all ages and a high risk of disease, especially in young child contacts (<5 years) or contacts with comorbidities such as HIV.[4] The risks of infection and disease also apply to contacts of people with MDR/RR-TB and may be higher than in contacts of people with drug-susceptible TB.[5–7] WHO published conditional recommendations for MDR/RR-TB contact in 2018 which stated that TPT be considered in high-risk household contacts of people with MDR/RR-TB based on individualised risk assessment which included confirmation of infection and drug susceptibility profile of the index person with TB.[8] WHO also advised close monitoring of contacts for the development of active TB disease for at least two years regardless of TPT provision.

Following a key stakeholder meeting in 2019, consensus management guidelines for household MDR/RR-TB contacts were developed for Mongolia that included recommending: a comprehensive initial examination within 14 days of diagnosis of an index person with TB; TPT be considered for child and young adolescent contacts (<15 years) with evidence of TB infection and without TB disease; and follow-up screenings for all contacts to be undertaken every six months for two years.[9] However, screening coverage of household TB contacts has been very low in Mongolia and has relied on a passive, facility-based approach to management.

Our study therefore aimed to introduce and evaluate an active, household-based model for the screening and management of household MDR/RR-TB household contacts that aligned with national guidelines.

Methods

Study design, setting and population

A prospective implementation study was conducted to describe the introduction of contact investigation and management of household contacts of people notified with MDR/RR-TB in Mongolia. The study included all patients registered with bacteriologically confirmed pulmonary MDR/RR-TB over a one-year period (December 2019–December 2020) and their household members. This included patients from 10 of the 21 provinces in Mongolia (population 3.5 million) and all nine districts of Ulaanbaatar (the capital city with a population of 1.5 million) that registers the largest number of patients; 32% of the population are children (<15 years). The study sites are depicted in Fig. 1. People with MDR/RR-TB who were homeless were not approached for participation in the study.

Fig. 1: **Study sites in Mongolia (includes 10 provinces highlighted, 9 districts in the capital of Ulaanbaatar).**

Study implementation and data collection

Two half-day in-person trainings were conducted for 35 community health workers (CHWs). These were existing trained community volunteers affiliated with the Mongolian Anti-TB Association, which has a nationwide network of trained and experienced CHWs that support the National TB Program by conducting TB symptom screening, health education and treatment support. Outside of TB activities, many CHWs also involved in broader public health outreach tasks in their communities, including vaccination campaigns and identifying key vulnerable population for social support. For this study, CHWs received additional training to conduct household visits, screen contacts, distribute TB educational materials and facilitate referrals. The training sessions were organized to conduct household visits to identify all individuals who had lived with the index person in the past three months. Household contact screening was arranged as soon as possible after diagnosis of the index person with TB. CHWs arranged contact screening at households by compiling a list that indicated the number of contacts for screening and the initials of the index person with TB to show on a day of screening.

At initial household visit, CHWs took the time to explain about the importance of contact screening, answered any questions and provided each household with a one-page information sheet to read. CHWs also distributed two specially designed leaflets for this project: one on TB prevention and another on preventing TB-related deaths in children through early diagnosis, treatment and prevention. Symptom screening was conducted using a standardised questionnaire that included persistent cough, fever, night sweats, and weight loss for all age groups. For children <15 years, history of poor weight gain or failure to thrive was also assessed. Growth curve monitoring or anthropometric measurements were not undertaken during household visits due to logistical constraints. Standardised paper-based forms were used to record demographic and clinical data on household contacts as well as sleeping arrangements at initial screening as well as for follow-up visits. At initial screening, CHWs collected data including age, gender, place of living, relationship to the index person with TB, education, sleeping arrangements (sleeping in the same bed with the index person, in the same room or in different rooms). They documented any current TB-related symptoms or any previous history of TB using a structured questionnaire.

Staff at the local TB clinic also received training and provided logistical support to facilitate contact screening. They recorded and verified the contacts identified by the CHWs. Contacts requiring screening procedures such as CXR or further diagnostic investigation were referred to the local TB dispensary with a paper information slip provided by CHWs. Most contacts had at least one facility visit, with CHWs assisting in coordination and sometimes accompanying them. Household contacts received a transportation cost allowance, and CHWs were provided incentives for travel, communication and time.

Chest X-ray (CXR) was performed for all adult contacts (≥15 years) during the initial screening visit. At follow-up visits, CXR was repeated only if the contact reported TB symptoms. CXRs were conducted using

either digital or analogue machines available at the respective TB dispensaries, depending on local resources. Images were interpreted by TB clinicians or facility-based radiologists. Mobile computer-aided CXR detection with artificial intelligence was not used. Children and young adolescent contacts less than 15 years of age were screened for symptoms and had a tuberculin skin test (TST), with CXR performed if they were symptomatic (presumptive TB), or TST positive irrespective of symptoms.[10] Efforts were made to collect sputum from contacts who were symptomatic or had abnormal CXR, and sputum was sent for laboratory testing. The majority of the 21 provincial TB dispensaries were able to perform Xpert MTB/RIF (Cepheid, CA, USA) but if unavailable, smear microscopy was done. If resistance was detected by Xpert or there was clinical presumptive drug-resistant TB, sputum was transported to the National TB Reference Laboratory of the National Center for Communicable Diseases in Ulaanbaatar for culture and phenotypic drug susceptibility testing (DST). Line probe assay was also performed in those who had previously received TB treatment. If laboratory tests were negative or sputum was not available, clinical evaluation was done at TB dispensaries. Stool testing with molecular diagnostic was not available in Mongolia at the time of the study. Additionally, procedures such as gastric or nasopharyngeal aspirations were not performed due to limited capacity at district and provincial TB dispensaries.

Provision of care for study participants

Results were communicated to families by TB dispensary staff via telephone. For families without a phone, CHWs undertook home visits. Those diagnosed with TB following evaluation—bacteriologically confirmed or clinically diagnosed–were registered with the National TB Programme and treated according to national guidelines. A TPT regimen of six months of daily levofloxacin (6Lfx) was routinely offered to household contacts below 15 years old who were TST-positive and did not have active TB.

The team held weekly online meetings and group communication with each site to receive updates and resolve and address any challenges encountered. Following initial screening and investigation, CHWs followed contacts quarterly up to 12 months, initially by household visits and then via telephone when a nationwide lockdown was imposed with restrictions to movement and travel after the first community transmission of COVID-19 was reported in November 2020. The CHWs also provided treatment support for household members being treated for either disease or infection (TPT). TPT treatment completion was assessed through self-report by the household contact or caregiver during face-to-face or phone call follow-ups conducted by CHWs or TB dispensary clinicians. No objective adherence measures such as pill count were used.

Statistical analysis

Data of contacts collected were entered and analysed into a password protected Microsoft 365 Excel (Microsoft Corporation) workbook with data validation restrictions. Variables included demographic characteristics, household characteristics, screening outcomes, and TPT eligibility, uptake and completion. Categorical variables were described by frequency (percentage), and screening coverage from initial to final screening visit was determined as the number of contacts at each timepoint of the total number enrolled. Clinical data were reviewed from participant records to report individual characteristics for all contacts diagnosed with TB.

Role of the funding source

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Ethics

The study protocol was reviewed and approved by the Scientific Committee of the National Center for Communicable Diseases on 27 June 2019. The study received ethics approval from the Medical Ethics Monitoring Committee of the Ministry of Health (N124) on 15 November 2019.

Results

Of 100 patients registered with bacteriologically confirmed pulmonary MDR/RR-TB between 17 December 2019 and 31 December 2020, 99 reported having household contacts. There were 349 household contacts identified and screened. Characteristics of 99 index people with MDR/RR-TB and their household contacts are listed in Table 1. The majority (73%) were adults aged 20–49 years; two were <15 years, both young adolescents aged 10–14 years. All had laboratory evidence of rifampicin-resistance—53 were RR detected on Xpert MTB/RIF assay only, and 46 had resistance to other drugs including isoniazid detected by DST. Of the contacts, 44% were children or adolescents with similar proportions of young children (0–4 years), older children (5–9 years) and adolescents (10–19 years). Of contacts screened, 32% were children of the index person and 16% of contacts were parents. The majority (74%) of contacts slept in the same room as the index person, likely reflecting the usual living conditions of multiple generations of families in Mongolia sharing a large one-roomed dwelling such as a Ger. At initial visit, TST was performed in 109 (82%) of 133 child or young adolescent contacts (<15 years). CXR was performed in

Characteristic	Index case N = 99	Contact N = 349[a]	Active TB case N = 17
	N (% with characteristic)		N (% of contacts)
Type of tuberculosis			
Bacteriologically confirmed	99 (100%)	4 (1.1%)	4 (23.5%)
Clinically diagnosed	0	13 (3.7%)	13 (76.5%)
Age group in years			
0–4 years	0	49 (14.0%)	6 (35.3%)
5–9 years	0	48 (13.8%)	4 (23.5%)
10–19 years	10 (10.1%)	58 (16.6%)	2 (11.8%)
20–34 years	38 (38.4%)	78 (22.3%)	5 (29.4%)
35–49 years	34 (34.3%)	67 (19.2%)	
50–64 years	14 (14.1%)	33 (9.5%)	
65 and older	3 (3.0%)	16 (4.6%)	
Sex			
Female	48 (48.5%)	171 (49.0%)	10 (58.8%)
Male	51 (51.5%)	178 (51.0%)	7 (41.2%)
Type of dwelling			
Apartment	32 (32.3%)	121 (34.7%)	7 (41.2%)
Traditional house, fenced	35 (35.4%)	117 (33.5%)	4 (23.5%)
Ger	28 (28.3%)	93 (26.6%)	5 (29.4%)
Other	4 (4.0%)	18 (5.2%)	1 (5.9%)
Education			
Not yet in education	–	94 (26.9%)	
Primary	6 (6.1%)	104 (29.8%)	
Secondary	67 (67.7%)	115 (33.0%)	
University	24 (24.2%)	36 (10.3)	
No education	2 (2.0%)	–	
Sleeping arrangement with the index case			
In the same bed	Not applicable	64 (18.3%)	2 (11.8%)
In the same room, but different bed		197 (56.4%)	11 (64.7%)
In different room		88 (25.2%)	4 (23.5%)
Relationship of the contact to the index case			
Child	Not applicable	113 (32.4%)	6 (35.3%)
Parent		56 (16.0%)	3 (17.6%)
Spouse		55 (15.8%)	1 (5.9%)
Sibling		41 (11.7%)	1 (5.9%)
Other		84 (24.1%)	6 (35.3%)

[a]Note that the 349 contacts listed include the 17 contacts diagnosed with active TB.

Table 1: **Characteristics of index cases, household contacts and TB cases detected.**

54 of this age group if TST-positive at initial visit or if symptomatic at any visit.

The total number of contact assessments, either initial screening or follow-up, was 1718 of an intended 1745 visits (five visits for each of the 349 contacts); an overall coverage of 98.5%. Of the 1718 assessments, 1032 were at home visits and 686 were completed at 9 or 12 months via telephone follow-up due to COVID-19 related constraints. Coverage of screening undertaken by CHWs was 99.4% (347 contacts) for baseline or initial screen, 98.8% (345) for three-month screen, 98.6% (344) for six-month screen and 98.3% (343) for each of the nine- and twelve-month screenings. Table 2 shows the screening coverage and the prevalence of TB symptoms among household contacts at each visit. Overall, TB symptoms were most common during the first home visit (5.4%) with a reduction noted on subsequent visits up to the final visit at 12 months. Young children (0–4 years) and older adolescents (15–19 years) had a higher prevalence of reported symptoms during the first visit compared to other age groups. Contacts living in traditional houses reported a higher prevalence of symptoms at initial screening compared to those living in apartments and symptoms were more persistent in contacts living in Gers. Symptom screening was also more commonly positive in those contacts that shared the same bed or room for sleeping as the index person. A diagnosis of TB was not made in any asymptomatic individuals based on CXR alone.

From the initial screen to 12-months of follow-up, 17 or 4.9% of household contacts were diagnosed with active TB. The diagnostic yield by contact characteristic

Index case with MDR/RR-TB		Contact characteristics			
Age, sex	TB type	Age in years, relationship	TB type	Diagnosis, Timing	Outcome
20 y, female	Pulmonary	6 y, sister	Pulmonary TB	Clinical, initial visit	Complete
34 y, male	Pulmonary	4 y, son	Pulmonary TB	Clinical, initial visit	Complete
53 y, female	Pulmonary	8 y, grandson	Pulmonary TB	Clinical, initial visit	Complete
		5 y, grandson	Pulmonary TB	Clinical, initial visit	Complete
46 y, male	Pulmonary	44 y, wife	Pulmonary TB	Bacteriological, initial visit	Cured
		15 y, son	Pulmonary TB	Clinical, initial visit	Complete
		10 y, son	Pulmonary TB	Clinical, initial visit	Complete
22 y, female	Pulmonary	50 y, mother	Pulmonary TB	Clinical, initial visit	Complete
		8 y, daughter	Pulmonary TB	Clinical, initial visit	Complete
		6 y, son	Pulmonary TB	Clinical, initial visit	Complete
		1.7 y, daughter	Pulmonary TB	Clinical, 6-month visit	Complete
		3 y, niece	Pulmonary TB, disseminated	Clinical, 6-month visit	Complete
21 y, male	Pulmonary	41 y, mother	Pulmonary, disseminated	Bacteriological, 6-month visit	Died before treatment
52 y, male	Pulmonary	22 y, daughter	Pleural TB	Clinical, 12-month visit	Complete
35 y, male	Pulmonary	26 y, wife	Pulmonary TB	Bacteriological, 12-month visit	Cured
		4 y, daughter	Pulmonary TB	Clinical, 12-month visit	Complete
		0.3 y, son	TB meningitis	Bacteriological, 12-month visit	Died on treatment

Table 2: **Characteristics of contacts diagnosed with TB.**

is listed in Table 1. Children and adolescents accounted for 12 (70.6%) of all people diagnosed with TB and diagnostic yield decreased with increasing age. The timing of TB diagnosis is shown in Fig. 2 and compared to numbers reporting symptoms. The ten people with co-prevalent TB diagnosed at initial screen represented 53% of the 19 contacts who were symptom-screen positive at their initial visit. All four contacts who reported symptoms at the 12-months follow-up were diagnosed with TB and two of these were bacteriologically confirmed.

The characteristics of the 17 people diagnosed with TB are listed in Table 2. They were from just eight households and only four (23.5%) were bacteriologically confirmed, all with MDR/RR-TB. A 3-months old infant of an index person (father) and a contact (mother), both with bacteriologically confirmed MDR/RR pulmonary TB with cavitatory disease on CXR, was diagnosed with

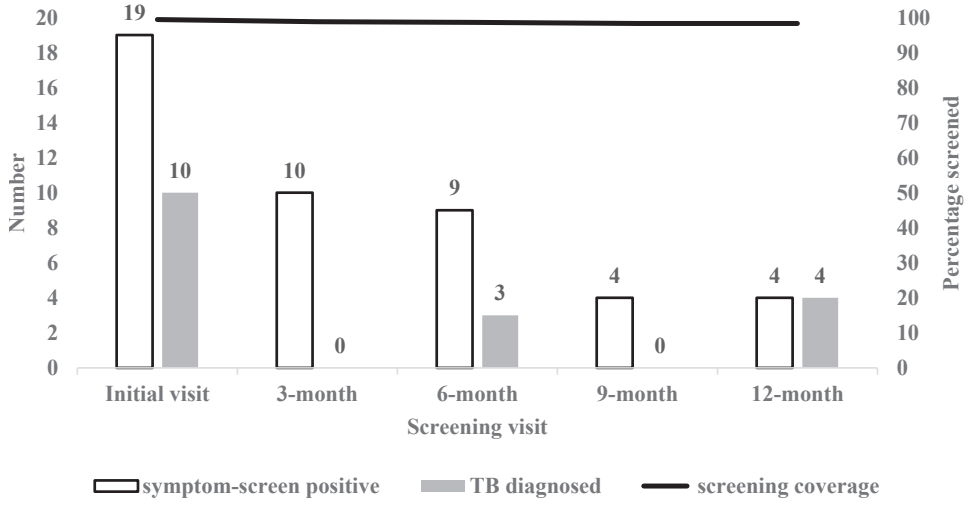

***Fig. 2:* Contact screening coverage and findings including numbers of people diagnosed with TB by screening visit**. Legend: The numbers of contacts at each screening visit who reported TB-related symptoms (empty bar) and who were diagnosed with active TB (full bar) are aligned with the vertical axis on the left. The percentages of all known contacts who underwent screening at each visit (black line) are aligned with the vertical axis on the right.

bacteriologically confirmed MDR/RR-TB meningitis and died six months after treatment initiation. An adult female with bacteriologically confirmed pulmonary and disseminated MDR/RR-TB was the mother of an index person and died before treatment initiation. The other 15 were successfully treated for MDR/RR-TB.

Of 133 total household contacts less than 15 years of age, 20 (15%) had TB-related symptoms, and 44 (33%) were TST positive—or 40% of 109 who had TST. Overall, 10 (7.5%) had CXR abnormalities—or 18.5% of the 54 who had CXR because they were symptomatic and/or TST positive. Pulmonary TB was clinically diagnosed and treated in 10 of the 133 contacts <15 years (Table 2); nine of these had a positive TST and all 10 had abnormal CXRs with perihilar "lymphadenitis" the abnormality reported.

Eighteen household contacts from nine study sites initiated 6Lfx as TPT and all were TST-positive (range 10–22 mm induration). Of these, four were <5 years and 11 were 5–14 years which represented 15 (43%) of 35 "eligible" child contacts without active TB who were TST-positive. In addition, two contacts aged 15 years received TPT as well as an adult aged 30 years following self-request. The 18 contacts received TPT at nine study sites from provincial and district TB dispensary clinicians with the consent of the individuals or their caregivers and following consultation by clinicians with the Mongolian MDR-TB Concilium prior to initiating TPT. All 18 completed TPT and none has been notified with TB to the national TB surveillance system up to end March 2025.

Discussion

A decentralised model of care for MDR/RR-TB contacts implemented by trained CHWs achieved a very high screening coverage at initial household visit which was sustained over one year and despite COVID-related restrictions. Treatment completion rates were also high for contacts who received either MDR/RR-TB treatment or 6Lfx as TPT. Decentralised models of care utilising CHWs have demonstrated higher coverage of screening and TPT for child contacts compared to passive facility-based management in a number of settings elsewhere.[11–13] A South African study of 112 children and adolescents exposed to RR-TB detected TB disease in 10% and reported high TPT uptake (94%) and completion (80%) in those eligible for TPT with 6Lfx given in the majority.[14] This study was also conducted during the COVID pandemic and noted a successful shift from facility-based to home-based evaluation and care. The WHO now specifically recommends decentralised models of detection and prevention of TB in children and adolescents.[15] However, the approach applied in this study to translate recent policy to practice is novel for Mongolia. The findings are relevant to improve screening coverage and the care of contacts of people with drug-susceptible TB as well as MDR/RR-TB in Mongolia and the region, including the use of TPT in older age groups.

TB was commonly detected in the household contacts of people with MDR/RR TB. The yield of 4.9% is higher than reported by previous studies including a systematic review of six studies that reported that 3.4% of MDR/RR contacts had TB.[4–7] Previous studies were often cross-sectional and lacked prospective monitoring which in our study detected and additional seven people with TB (or 41% of all detected) between six- and twelve-month follow-up visits. A recent study from Tajikistan reported that 6645 contacts of 830 people with MDR/RR TB were screened and that 43 people with TB were detected within one year of follow-up and an additional four in subsequent two years—an overall yield of 0.7%.[6] The wide difference in yield or numbers needed to screen to detect a person with TB compared to our study in Mongolia may partially reflect that the Tajikistan study was a retrospective analysis of contact investigation under programmatic conditions. However, it is also noteworthy that a much higher proportion of people detected with TB in the Tajikistan study were bacteriologically confirmed—60% compared to 23.5% in our study—and that young children represented 35.3% of all TB diagnoses in our study compared to 21.3% in the Tajikistan study.[6]

Over-diagnosis of TB may have contributed to the high case-finding yield in our study. The majority (71%) of contacts diagnosed with TB were children or young adolescents. All but one were clinically diagnosed as pulmonary TB supported by radiological abnormality but without bacteriological confirmation. Furthermore, the highest prevalence of TB in our study was in young child (<5 years) contacts; 12.2% were diagnosed with TB. While child contacts are a recognised high-risk group for disease,[4] reliance on clinical and radiological findings creates diagnostic uncertainty. The challenges for CXR interpretation for TB diagnosis in children are well recognised, especially interpretation for agreement on perihilar lymphadenopathy which was the main abnormal finding in our study.[16,17] There are ongoing efforts to strengthen the diagnosis of TB in children and young adolescents in Mongolia, including with the translation of The Union's diagnostic CXR atlas into Mongolian language.[18] Strengthening diagnosis at peripheral levels of care is critical to effective decentralisation of contact management, and is feasible with training support and mentorship.[19,20]

The timing of TB symptom detection and subsequent diagnosis is critical for early treatment of disease in household contacts and to reduce ongoing transmission. The COVID-19 pandemic necessitated a shift from home visits to telephone follow-ups during part of the study period which may have affected detection of presumptive TB. Although the highest prevalence of TB symptoms and case finding was observed from the

initial screening, new people with TB were detected at subsequent visits including bacteriologically confirmed pulmonary TB, TB meningitis and pleural TB. Three of the four people with TB detected at the twelve-month visit were from one family; the wife of the index person who was pregnant during this follow-up period developed bacteriologically positive pulmonary TB and is likely to have infected the two children, especially her young infant with TB meningitis who was born many months after treatment was initiated for the father. This single household scenario highlights possible missed opportunities but also important challenges for prevention. Pregnant and lactating women are often excluded from TB research and the evidence of the benefits or risks of TPT in this high-risk population is very limited.[21] Early detection is difficult with diagnosis often delayed to the post-partum period and effective TPT initiation for exposed infants needs to be prompt as TB development when it occurs is often within three months of exposure.[22,23]

This study represents the first implementation of TPT for contacts of MDR/RR-TB in Mongolia. At the time of study initiation, the WHO recommended that TPT be considered in selected high-risk MDR-TB contacts (young children or PLHIV) based on individualized risk assessment and sound clinical justification.[8] This recommendation was conditional with very low certainty of effect based on limited observational evidence at that time, as was the subsequent unchanged WHO recommendation published in 2020.[24] Less than half of the eligible child contacts initiated TPT in our study and the reasons for this low uptake were not evaluated. However, discussions during implementation suggested several contributing factors, including caregiver hesitancy, limited awareness or confidence among clinicians with initiating TPT for MDR/RR-TB contacts, and the requirement for prior consultation with the National MDR-TB Concilium. Additionally, logistical disruptions due to COVID-19 may have hindered timely follow-up. These factors highlight the need for dedicated implementation research to identify and address barriers to TPT uptake in high-risk populations. Although only 18 contacts initiated TPT in our study, TPT was initiated at nine different study sites, levofloxacin was available through the NTP and there were no treatment interruptions. The observation of full completion including during the COVID-19 pandemic is relevant and timely for current programmatic priorities as is the consistent finding from studies that 6Lfx is well tolerated with serious adverse events rarely reported.[14,25,26]

An analysis of recent randomised-controlled trials that represented a wide range of ages found that 6Lfx reduced TB risk by 60% in MDR/RR-TB contacts followed for up to two years.[24] Protective efficacy against incident TB was especially high compared to placebo in the first 12 months following initiation.[26,27] Findings from these two studies informed WHO guidelines update in 2024 to include a strong recommendation of 6Lfx as TPT for adult and adolescent as well as child household contacts of MDR/RR-TB.[28] If adopted in Mongolia, a decentralised model of care delivery by CHWs of household-based screening and TPT implementation could be considered for MDR/RR-TB contacts, including adolescents and adults. However, TPT uptake would need to be improved to optimise public health benefit. Less than half of the eligible contacts initiated TPT in our study and the reasons for this low uptake were not evaluated.

Despite policy and potential public health benefits, implementation of household contact investigation faces many challenges in Mongolia. Programmatically, contact investigation is limited to the initial screening after diagnosis of the index person and the requirement for families to present to a health facility. The recommended six-monthly screenings for two years are not conducted, primarily due to a lack of resources. There are barriers to accessing timely care such as difficulty securing appointments, lack of transportation, and long wait times. Additionally, limited-service hours and unavailability of TB dispensary staff outside working hours exacerbate these challenges.

There are recent examples from a number of countries showing that household-based screening by CHWs can significantly increase TPT uptake and completion as well as increase TB case detection.[11,12,29] Furthermore, the community-based delivery model is lower cost and more cost-effective than the passive, facility-based approach in high-burden, resource-limited settings.[30,31] Research into factors and social determinants affecting TPT uptake and adherence will be essential to guide scale-up. Reluctance to disclose information about household contacts may also contribute to the underutilization of screening services in Mongolia where TB-related stigma is very common, including among healthcare workers based at facilities.[32] Improving education and engagement at the household level by local CHWs may help to address these challenges.

A strength of this study is that it was conducted across all districts of Ulaanbaatar as well as 19 provinces, representing diverse geographic settings and populations. The high coverage and retention rates achieved by CHWs under real-world programmatic conditions suggest that the model may be scalable and applicable to other settings with similar health system structures. A study limitation is the lack of a non-intervention group to allow comparison to the current more passive facility-based approach. While the high screening coverage that was maintained is in stark contrast to the current practice of only an initial screen if at all, this study cannot quantify relative impact of this model on important programmatic indicators such as screening coverage, case detection and TPT initiation

or completion. All 18 individuals initiated on TPT reported full completion and were monitored by both CHWs and TB dispensary staff. However, TPT adherence and completion were assessed by self-report and clinical follow-up rather than objective measures which may have led to overestimation of adherence. Furthermore, high completion may reflect a self-selection bias i.e. those choosing to initiate TPT may differ systematically in their health-related behaviours and likelihood to complete TPT than the general population of those eligible. While no serious adverse events were reported, another limitation is the lack of systematic monitoring and documentation of adverse events during TPT.

A further limitation previously highlighted is the uncertainty inherent in TB case detection among children given the reliance on clinical diagnosis with CXR, which emphasises the need for ongoing efforts to strengthen the diagnosis of TB in children in Mongolia. The approach used for either detecting TB disease or for determining eligibility for TPT in child and young adolescent contacts (<15 years) in this study was as per Mongolian guidelines,[9] and has inherent limitations. The TST has limited sensitivity to detect infection and limited specificity especially due to the BCG effect. In addition, though asymptomatic TB is reported as uncommon in child contacts,[17] restricting CXR usage to those who were symptomatic or had a positive TST may have missed TB diagnosis in some. On the basis of new evidence, WHO guidelines have recently been revised to strongly recommend TPT for young contacts without active disease on the basis of exposure alone, i.e. positive test for infection not required.[26,28]

In conclusion, this study provides original evidence from Mongolia of TB case finding in household MDR/RR-TB contacts as well as the implementation of 6Lfx as TPT. The yield of case detection and full completion of TPT in those who initiated reflect the very high coverage of contact screening and follow-up achieved by trained CHWs. This decentralised model of care approach has global and regional relevance and will inform future implementation approaches to TB contact screening and management in Mongolia.

Contributors

Study conception and design: SMG, BT and GJF.

Acquisition and analysis of data: BT, TS, YP, SM, PB, O-EK, ND, NB, NT.

Access to raw data: BT, TS, YP.

Verification of data: BT, TS, YP, SM.

Interpretation of data: BT, TS, YP, GJF, SMG.

BT and SMG wrote the initial draft of the manuscript and all authors provided critical review.

All authors granted final approval of the version to be published.

All authors agree to be accountable for all aspects of the work.

Data sharing statement

De-identified individual participant data and the study protocol will be made available upon request to the corresponding author. Access will be granted for research purposes only, in compliance with ethical approvals and data protection guidelines.

Editor note

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Declaration of interests

Bazarragchaa Tsogt is a member of two national scientific and ethics committees in Mongolia. Stephen M. Graham chairs the DSMB for the SMILE TB trial and is a board member of The Union. Gregory J. Fox serves on the DSMB for the DRAMATIC trial, is a board member of the Australian Respiratory Council, and received in-kind supply of rifapentine from Sanofi for a TB trial. All declarations are unrelated to the submitted work. All other authors declare no competing interests.

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